

11/1/16

"Motivation gets you started, habit keeps you going."-Jim Rohn

HW: Test 3 on Friday 11/4

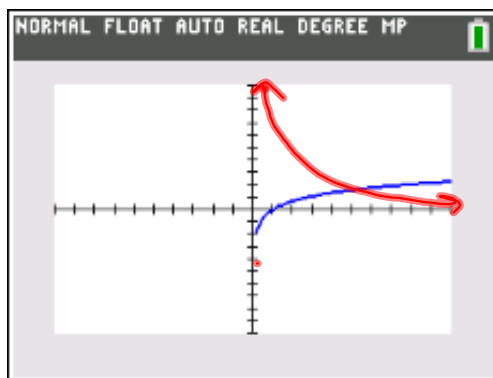
Quarter Test on Wednesday 11/9

AIM: Derivatives of "ln" and "e"

Warm Up:

$$y = \ln(x)$$

$$y' = \frac{1}{x}$$



$$\frac{d}{dx}[\ln x] = \frac{1}{x}, x > 0 \quad \frac{d}{dx}[\ln u] = \frac{1}{u} \cdot \frac{du}{dx} = \frac{u'}{u}, u > 0$$

⊗ $\frac{1}{\text{function}} \cdot (\text{derivative of function})$

What this says is to take the derivative of the ln of some expressions, you simply use the reciprocal of the expression multiplied by the derivative of that expression. The expression must be a positive number.

Find the derivative of the following expressions:

1) $y = \ln(4x)$

$$y' = \frac{1}{4x} \cdot 4$$

$$y' = \frac{4}{4x} = \boxed{\frac{1}{x}}$$

2) $y = \ln(x^2 - 3)$

$$y' = \frac{1}{x^2 - 3} (2x)$$

$$y' = \frac{2x}{x^2 - 3}$$

3) $y = \ln(3x^2 - 5x + 8)$

$$y' = \frac{1}{3x^2 - 5x + 8} \cdot (6x - 5)$$

$$y' = \boxed{\frac{6x - 5}{3x^2 - 5x + 8}}$$

4) $y = \ln \sqrt{x}$

$$y' = \frac{1}{x^{1/2}} \cdot \frac{1}{2} x^{-1/2}$$

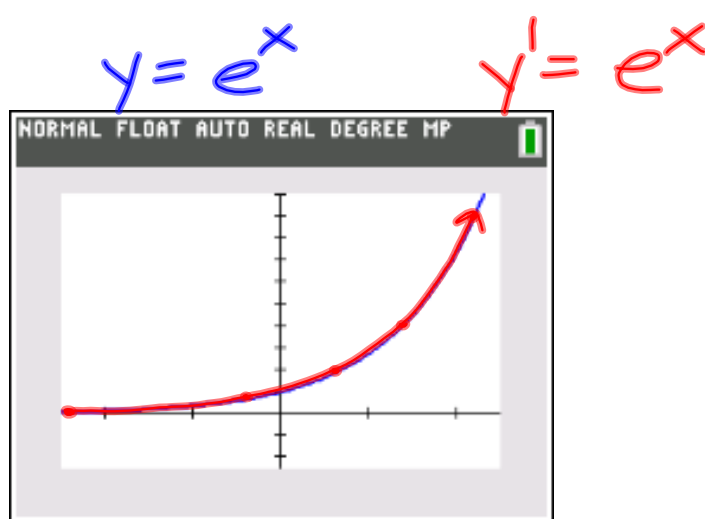
$$y' = \frac{\frac{1}{2} x^{-1/2}}{x^{1/2}} = \boxed{\frac{1}{2x}}$$

Note: #4 - Better way: $y = \ln \sqrt{x} \Rightarrow y = \ln x^{1/2} \Rightarrow y = \frac{1}{2} \ln x \Rightarrow y' = \frac{1}{2x}$

5) $y = x^2 \ln x$

$$\begin{array}{cccc} \text{1st} & \text{2nd} & \text{1st} & \text{2nd} \\ \downarrow & \downarrow & \downarrow & \downarrow \\ y' = x^2 \cdot \frac{1}{x} + 2x \ln x \end{array}$$

$$y' = \boxed{x + 2x \ln x}$$



$$\frac{d}{dx}[e^x] = e^x \text{ and if } u \text{ is a differentiable function of } x \text{ then } \frac{d}{dx}[e^u] = e^u \frac{du}{dx}$$

$$\textcircled{*} y = e^{\text{function}} \quad y' = e^{\text{function}} \cdot (\text{derivative of function})$$

Find the derivative $\frac{dy}{dx}$ of the following expressions:

1) $y = e^{5x}$

$$y' = e^{5x} \cdot 5$$

$$\boxed{y' = 5e^{5x}}$$

2) $y = 4e^{1-2x}$

$$\frac{dy}{dx} = 4e^{1-2x} \cdot (-2)$$

$$\boxed{\frac{dy}{dx} = -8e^{1-2x}}$$

3) $y = e^{x^2-3x-1}$

$$\frac{dy}{dx} = e^{x^2-3x-1} \cdot (2x-3)$$

$$\boxed{\frac{dy}{dx} = (2x-3)e^{x^2-3x-1}}$$

4) $y = 2e^{\sqrt{x}}$

$$\frac{dy}{dx} = 2e^{\sqrt{x}} \left(\frac{1}{2}x^{-1/2} \right)$$

$$\frac{dy}{dx} = \frac{2e^{\sqrt{x}}}{1} \left(\frac{1}{2\sqrt{x}} \right)$$

$$\frac{dy}{dx} = \frac{\cancel{2}e^{\sqrt{x}}}{\cancel{2}\sqrt{x}} = \boxed{\frac{e^{\sqrt{x}}}{\sqrt{x}}}$$

